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THE STORY OF THE SOIL.

The Story of the Soil: from the Basis of Absolute Science and Real Life. By C. G. Hopkins. Pp. 350. (London: T. Werner Laurie, n.d.) Price 6*s.* net.

WHEN Dr. Cyril Hopkins sets out to write a book we know that we are in for something unconventional, but this time he has excelled himself in unconventionality, and has essayed a task that no author has attempted for the last sixty years: to tell the story of the soil in the form of a chronicle that almost amounts to a novel.

When, in 1852, Hoskyns wrote "Talpa, or the Chronicle of a Clay Farm"—to-day one of the treasures of the agricultural bibliophile—he secured the cooperation of George Cruikshank. But Dr. Hopkins does without any extraneous help, and alone and unaided boldly enters into competition, as he tells us, with popular fiction. The result is remarkable; a clear account is given of the soil in relation to the crop, and the interest of the subject is broadened by skilfully weaving in the threads of a mild novel. It will be interesting to learn whether the farmer reads this book any more readily than he does the ordinary science book that is supposed to appeal to him.

An agricultural student from Illinois, full of facts and figures, travels about the States in search of a farm. He wants to put into practice some of the ideas he has formed during his college course, and so, instead of seeking for improved land, he looks for a worked-out derelict farm. He first goes southwards and strikes a Virginian farm where the produce had fallen during one lifetime from five or six thousand bushels of wheat to five or six hundred, in a district where all the land is at least as impoverished, excepting only a few dairy farms, on which fertility was maintained at the general expense of the locality by the consumption of hay or grain bought in from neighbouring farms. And this in spite of the fact that most of the farms were managed by their old owners, a superior type of people, whose chief characteristics were "culture, refinement, and poverty."

The system of management which had brought about this deplorable state of affairs consisted in ploughing up the run-out pasture land and planting maize, wheat, or oats, followed by a mixture of clover and timothy. The latter is cut for hay for two years, then left for pasture for six or eight years, by which time weeds have crowded out the useful plants; finally a dressing of farmyard manure is applied, and the land is once more ploughed up for maize. Wheat and cattle are the principal products sold. This system, we are informed, is in regular use, and leads always to a similar deterioration. Our agricultural student decided not to settle there, but gave some advice that turned out very useful; he tested the soil with litmus paper, and found that it was acid; hydrochloric acid also showed the absence of carbonates; it was clear therefore that the soil would produce neither clover nor lucerne until lime was added, although it could still grow wheat, maize, and timothy. The question whether burnt lime or the less expensive limestone would be the better had been investigated at the Pennsylvania Experiment Station for many years in what is perhaps the most complete set of experiments in the world on this particular problem, and the result shows that finely ground limestone is superior in every way. At most railway stations in Illinois it can be obtained for 1.50 dollars a ton, this low rate being quoted because it is realised that the general prosperity of railway companies and everyone else in Illinois is bound up with the maintenance of the fertility of the soil. In Virginia, however, no such plan is in operation, so that the cost of the improvement would be considerably higher. But the addition of limestone is only the beginning; the amount of nitrogen in the soil has also to be increased, and this can only be done profitably by growing leguminous crops. Since clover only grows with difficulty, and lucerne not at all, recourse was had to inoculation, not with a bacterial culture, but with soil that had grown lucerne well. Finally, the addition of rock phosphate and an improved rotation raised the fertility of the soil considerably.

A very different problem was presented by the swamp soils of Illinois, barren in spite of their high content of humus, nitrogen, and phosphorus compounds. The Illinois Experiment Station, knowing how to set about the problem, discovered that the supply of potassium constituted the limiting factor; as soon as potassic fertilisers were added the barren soils produced great crops at the cost of about three dollars per acre. A man who had been farming some of the same soil came to see the result, and brought with him his wife and children.

"As he stood looking first on the corn on the treated and untreated land, and then at his wife and children, he broke down and cried like a child. Later he explained to the superintendent who was showing him the experiments that he had put the best of his life into that kind of land. 'The land looked rich,' he said, 'as rich as any land I ever saw. I bought it and drained it and built my house on a sandy knoll. The first crops were fairly good, and we hoped for better crops, but instead they grew worse and worse. We raised what we could on a small patch of sandy land, and kept trying to find out what we could grow on this black bogus land. Sometimes I helped the neighbours and got a little money, but my wife and I and my older children have wasted twenty years on this land. Poverty, poverty, always! How was I to know that this single substance which you call potassium was all we needed to make this land productive and valuable?'"

Thus experience by itself counts for very little; indeed, "experience is a mighty dear teacher, and if we finally learn the lesson it may be too everlasting late for us to apply it." And so, when finally our student settles down in Heart-of-Egypt, Southern Illinois, he has his soil analysed, draws up a rotation and scheme of fertilisers on the most approved principles, sets them into operation, and—very nearly fails. The situation is saved by some advice given by an old farmer, who has learnt the secret of proper tillage. Moisture, in fact, had been lacking, and the fertiliser

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scheme, good as it was, had no chance to show its merits until moisture-conserving tillage was adopted. Thus the young man's science and the old man's experience finally solved the problem, and that particular tract of land was conquered.

But we have only been able to give a very brief account of this delightful book. The American agricultural student and farmer are admirably drawn, and the reader also learns Dr. Hopkins's views on soil fertility, and where he differs from the Bureau of Soils. Light reading the book certainly is, as the author intended, but it has depth and permanent value.

E. J. Russell.

TWO IMPORTANT WORKS ON CLIMATOLOGY.

(1) *Handbuch der Klimatologie.* By Prof. J. Hann. iii. Band. Klimatographie. 2 Teil, Klima der gemäszigten Zonen und der Polarzonen. Dritte Auflage. Pp. ix+713. (Stuttgart: J. Engelhorn's Nachf., 1911.) Price 23 marks.

(2) *Das Klima der Schweiz auf Grundlage der 37-jährigen Beobachtungsperiode* 1864–1900. Bearbeitet von Jul. Maurer, Rob. Billwiller, jr., und Clem. Hess. Preisschrift herausgegeben durch die Stiftung von Schnyder von Wartensee mit Unterstützung der schweizerischen meteorologischen Zentralanstalt. In zwei Banden. Erster Band, Text, pp. viii+302. Price 12 marks. Zweiter Band, Tabellen, pp. v+217. Price 8 marks. (Frauenfeld: Huber and Co., 1909–1910.)

WITH the third volume of his "Handbuch der Klimatologie" (1) Prof. Hann has completed the third edition of that famous work. This last volume deals with the special climatology of the temperate and polar regions. It would be difficult to find in other 700 pages of printed matter a similar collection of well-arranged facts. Not that the book is a mere collection of facts. The author has succeeded in clothing the dry bones with flesh, and the discussions of the data and the bringing of them into relation, on one hand, with the general physics of the globe, and, on the other, with the various phases of human activity, make most interesting reading. The manner in which the works of other authors are drawn on in this connection is wholly admirable.

The arrangement of the book is similar to that adopted in the second volume, which dealt with the tropics. Each section commences with a general description of the main features of the region under review. Thus when considering the Mediterranean—the world of the ancients—twenty-five pages suffice to supply a framework into which we can fit the details of the later 140 pages of special description. They bring vividly before us the essential differences between the coastal and the inland regions, the distribution of rainfall with its typical winter maximum becoming gradually modified into a summer maximum at the foot of the Alps, the peculiar temperature conditions with the remarkable warmth of the autumn months, and the principal local winds. More detailed information for each country or other division follows. This is accompanied by much tabular matter, the scope of which has been considerably extended in this edition as compared with its predecessor. Data are now given, as a rule, for all twelve months, and not merely for four characteristic months. For regions which possess no organised meteorological services the work of bringing together data from scattered sources, comparing them and calculating average values, had to be gone through. Even for regions where an organised service exists Prof. Hann has not always been satisfied with mere selection and extraction. For instance, in the tables of mean temperature he has endeavoured to correct the values so as to give the best approximation to the true daily mean wherever it was possible and necessary to do so. Great stress is laid throughout on this element, and in some cases a laborious recalculation of means has been gone through in order to realise the object.

When dealing with regions of which the majority of his readers are likely to have no personal experience, Prof. Hann has added to the discussion of the data pregnant descriptions of the effects of the climate on man, taken from the accounts of travellers or residents. These serve to bring out the salient points in a way that tables of extreme and mean values fail to do. Thus the contrast between the generally calm condition of eastern Siberia with its intense winter cold and the violent blizzards of the steppes of the western Siberian region makes little impression on our imagination until we consider the effects of these climates on man. In the east the intense cold is borne without serious discomfort, but in the steppes the wind and drifting snow render the conditions almost unbearable, though the temperature may be considerably higher. Again, the accounts of the effect on man of the snowstorms of the steppes remind us in many ways of the sandstorms of the African desert. Against both, man and beast are powerless.

Since the appearance of the second edition in 1897 our knowledge of the main features of the climate of Europe and North America has altered little. Progress has been mainly in the direction of a more thorough discussion of the data. Most of the old-established meteorological services have published summaries of the whole or of a portion of their accumulated observations. Thus for Russia we have Rykatscheff's "Climatological Atlas for the Russian Empire," for Germany Hellmann's work on the rainfall of North Germany, for France Angot's temperature tables, and for Italy Eredia's temperature and rainfall tables. For Austria the results for each province are being issued separately; those for four regions have already appeared, and have been noticed from time to time in Nature. For the American continent we have Henry's "Climatology of the United States" and Bigelow's "Report on the Temperatures and Vapour Tensions of the United States," which have been issued by the Weather Bureau. In Australia also the establishment of a Commonwealth Weather Meteorological Bureau has already given us a new rainfall map of the continent. In other parts of the world the primary survey has been pushed forward into what were in 1897 little-known regions. Especially in South Africa has there been a great improvement consequent upon the establishment of

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